

**Anatomical Notes on *Uropoda* sp., a Phoretic Mite Infesting  
Dung-inhabiting Beetles in Southern California  
(Acari: Uropodidae; Coleoptera: Tenebrionidae, Histeridae)**

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*Abstract.* — Anatomical details of the anal pedicel of *Uropoda* sp. are described. The deutonymph of *Uropoda* sp. is phoretic upon adult predatory beetles infesting poultry manure. Aspects of phoresy involving uropodids are discussed.

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During the course of studies of arthropod natural enemies of flies inhabiting poultry manure by one of us (LW), several predatory beetles were collected which were extensively covered by uropodid mites. Here we describe anatomical aspects of the phoretic attachment by *Uropoda* sp. on the histerid *Dendrophilus punctatus* Herbst and the tenebrionid *Alphitobius diaperinus* (Panzer). The mites and beetles used in this description are deposited in the entomological collections, University of California, Riverside.

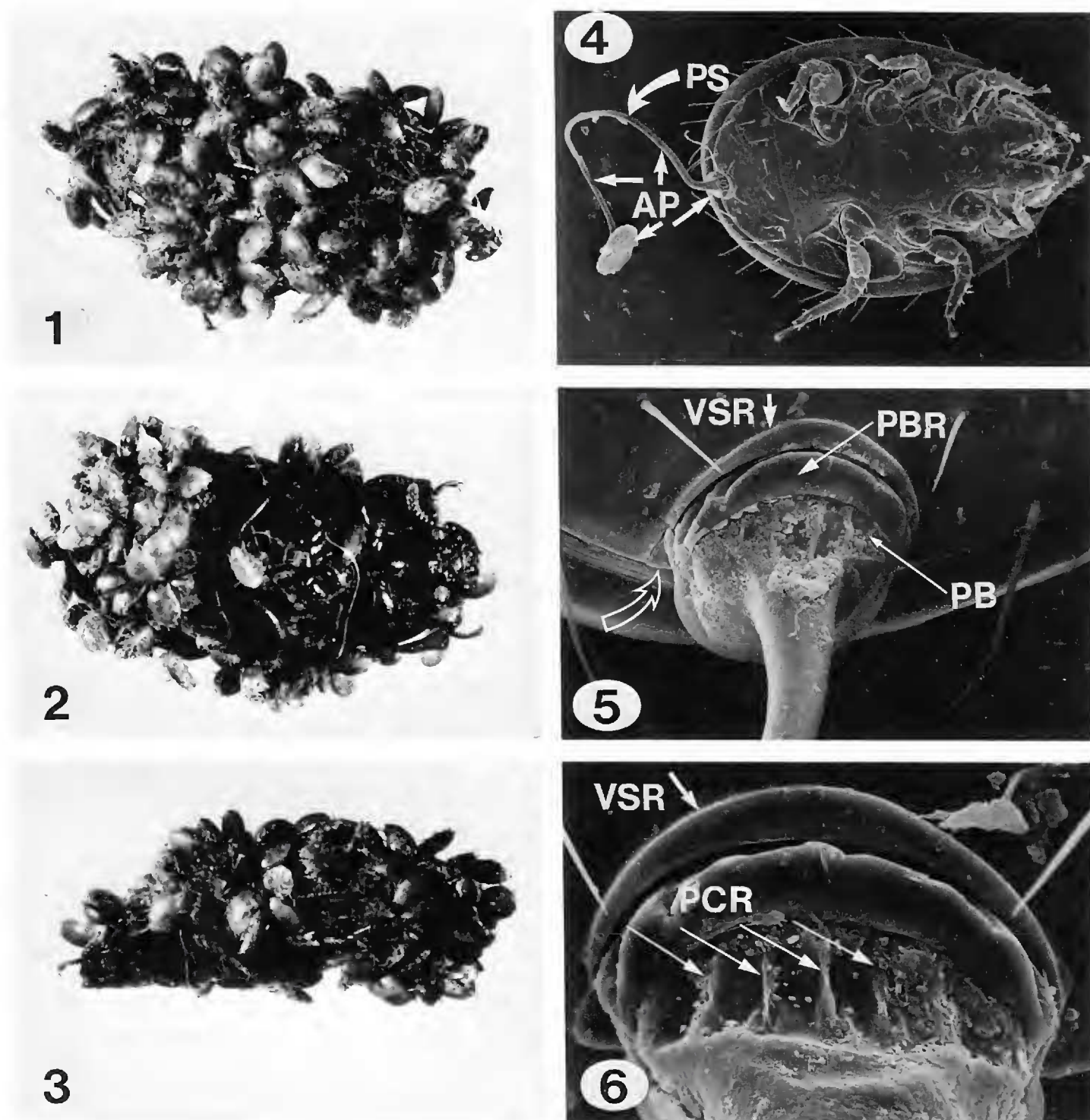
RESULTS

We found that only the deutonymphal stage of this uropodid is phoretic. This observation is consistent with other reports (Kranz, 1978). Based on studies by Wills (1988) we conclude that the uropodid prefers attachment to the thorax and abdomen of the phoront. In the most extreme case, we counted 189 *Uropoda* sp. attached to one *A. diaperinus* (Figs. 1–3). This phoront held 140 uropodids attached to the dorsum (15 on pronotum, 62 on left elytron, 63 on right elytron), and 49 uropodids attached to the venter (13 on thoracic sternum and 36 on abdominal sterna).

Each deutonymph is attached to the beetle by a relatively long, flexible, anal pedicel (Fig. 4, AP). Based on our observations, we conclude that the pedicel consists of three functional components, a base, a shaft, and an apex.

The BASE of the pedicel (Fig. 5, PB) is formed apparently from a minute sclerite immediately posteriad of the ventrianal shield (Fig. 5, open arrow). The pedicel base is not morphologically differentiated from the shaft, but does form a rim (Fig. 5, PBR) whose margin is confluent with an integumental rim formed on the ventrianal shield of the mite (Figs. 5, VSR; 6, VSR). The ventrianal shield rim (VSR) forms a hemispherical thickening which does not surround the base, but tapers posteriad and terminates in a short, inconspicuous suture. The base of the pedicel confers rotational flexibility via a series of parallel cuticular ridges or pleats (Fig. 6; PCR) which are at a right angle to the basal rim and oblique inflections in the basal rim.

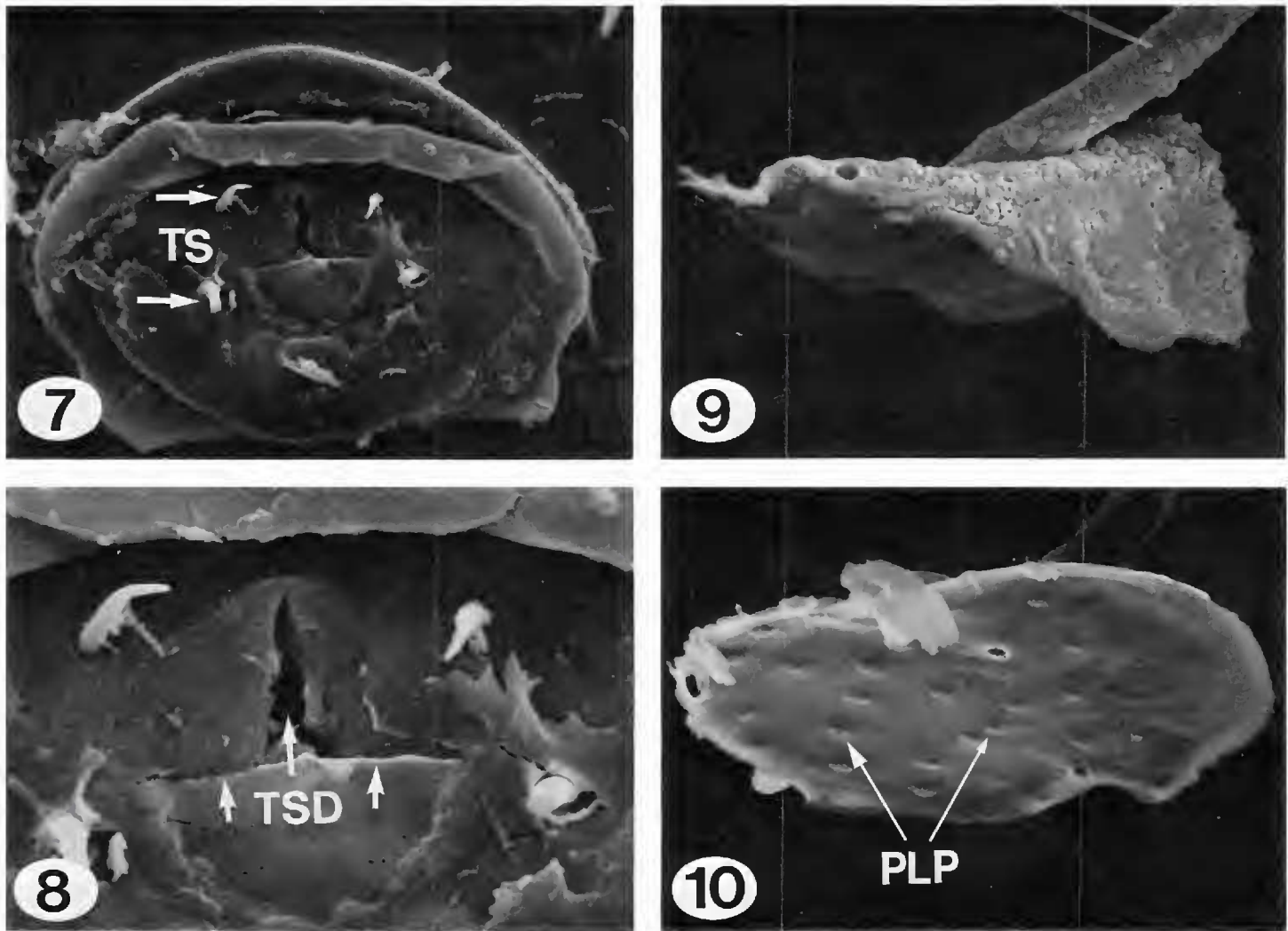
The SHAFT is about as long as the body of the mite (Fig. 4, PS). From our



Figures 1-6. 1. *Alphitobius diaperinus* (Panzer), dorsal aspect, infested with *Uropoda* sp. ( $\times 15$ ). 2. *Alphitobius diaperinus* (Panzer), lateral aspect, infested with *Uropoda* sp. ( $\times 15$ ). 3. *Alphitobius diaperinus* (Panzer), ventral aspect, infested with *Uropoda* sp. ( $\times 15$ ). 4. *Uropoda* sp., ventral aspect (AP, anal pedicel; PS, pedicel shaft) ( $\times 86$ ). 5. *Uropoda* sp., ventral aspect, base of anal stalk (PB, pedicel base; PSR, pedicel basal rim; VSR, ventrianal shield rim) ( $\times 660$ ). 6. *Uropoda* sp., ventral aspect, base of anal stalk enlarged (PCR, pedicel cuticular ridges; VSR, ventrianal shield rim) ( $\times 1300$ ).

microscopic comparison and not statistical analysis, we could detect little significant difference in shaft length among the mites. The shaft of the anal pedicel is featureless, smooth and does not change in diameter, a slight tapering near the base notwithstanding. The shaft is flexible, even after preservation in alcohol and critical point drying. The shaft of the pedicel seems to confer orthogonal flexibility.

The APEX of the pedicel is conspicuously differentiated from the distal end of the shaft. The apex is enlarged, circular in outline and flattened along the ventral surface (Figs. 9, 10). The apex forms a foot and constitutes the adhesive bond between the integument of the phoront and the deutonymph. Specimens which have been desiccated in ethanol and critical point dried maintain the strong



Figures 7-10. 7. *Uropoda* sp., ventral aspect, base of broken anal stalk (TS, trichode sensilla) ( $\times 1100$ ). 8. *Uropoda* sp., ventral aspect, base of broken anal stalk enlarged (TSD, "T"-shaped duct) ( $\times 2600$ ). 9. *Uropoda* sp., lateral aspect of anal stalk apex ( $\times 660$ ). 10. *Uropoda* sp., ventrolateral aspect of anal stalk apex (PLP, papilla-like protuberance) ( $\times 660$ ).

bond of attachment to the phoront. Inspecting the ventral surface of the apex of specimens we dislodged reveals a field of papilla-like protuberances (Fig. 10, PLP). These protuberances appear widely spaced, but are in fact imprints of the punctations found on the beetle elytra. This suggests the apex is a secretory product because pedicel apices from deutonymphs attached to impunctate parts of the body do not have these protuberances.

The apex apparently is a glandular product synthesized in the body of the mite and secreted via the shaft. Breaking the pedicel at its base reveals an inverted "T"-shaped duct (Figs. 7; 8, TSD) which is attended by four trichode sensilla (Fig. 7, TS). The mechanism of detachment by this uropodid mite remains unknown, and we did not observe the mites during the later stages of the deutonymphal condition.

#### DISCUSSION

The term phoresy was proposed by Lesne (1896 teste Clausen 1976) to describe the phenomenon of transport of one species on the body of another species for purposes other than direct parasitization. General treatments of phoresy have been developed by Ferriere (1926), Howard (1927) and Clausen (1976). The phenomenon is widespread in the Insecta, but different mechanisms of attachment are involved. Among the Acari, the deutonymphal stage of uropodid mites is frequently phoretic on insects (Kranz, 1978), including adult bees (Gordh and

Barrows, 1976), beetles (Ramsay, 1966; Faasch, 1967; Peck and Anderson, 1969; Gordh, 1985), caterpillars (Helson et al., 1975), and even small lizards (Domrow, 1981).

A frequent problem in discussing the phoretic relationship between uropodid mites and their phoronts has been the difficulty in obtaining scientific names for uropodid mites. In the most recent study, Dr. Richard Axtell kindly provided the generic name. In earlier studies (Gordh and Barrows, 1976; Gordh, 1985) the generic name was provided by Dr. Ed Baker. Other workers have discussed phoresy by uropodids under generic names only (Helson et al., 1975; Domrow, 1981).

Most discussions of phoresy have focused on the benefit of the relationship to the organism being transported and not the impact on the phoront. In a comparable observation of *Uropoda* sp. on beetles in manure, Peck and Anderson (1969) noted several predaceous Coleoptera were often covered with uropodid nymphs and supposed that this was probably a significant method for reintroducing mites into manure after manure removal. We believe this is a hypothesis consistent with our observations because there appears to be no detrimental effect on the phoront. Indeed, by our observations heavily infested beetles still walked apparently unencumbered. Kranz (1978) reports that deutonymphs of Uropodidae molt and leave the carrier as adults. Presumably the dispersal hypothesis remains most plausible for explaining this relationship.

#### ACKNOWLEDGMENTS

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